

Improvement of Freezing of Gait in Patients with Parkinson's Disease by Imagining Bicycling

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Key Words

Freezing of gait · Parkinson's disease · Imagining bicycling

Abstract

Freezing of gait (FOG) is one of the factors that reduce the quality of life in patients with Parkinson's disease (PD). Imagining bicycling before gait start provided improvement in FOG in 2 PD patients. Imagining and mimicking bicycling after the initiation of gait allowed the rhythmic gait to continue without interruption. We suggest that imagining and mimicking bicycling, which are nonexternal cues, could serve as a helpful therapeutic approach for the intractable freezing and interruption of gait of PD patients.

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Introduction

Freezing of gait (FOG) is characterized by start and turn hesitation and is a common clinical feature in Parkinson's disease (PD). The sudden appearance of FOG can increase the risk of falls and reduce the quality of life. There are several therapeutic approaches, such as medications (L-dopa or deprenyl) [1] and external stimuli (visual or auditory cues) [2], to reduce FOG, but their effects are usually limited for most PD patients. Recently, PD patients with severe FOG were reported to be able to ride a bicycle [3–5]. We studied whether imagining bicycling alone provided improvement in severe FOG without a good response to external stimuli, such as visual and auditory cues, or whether imagining and mimicking bicycling after having initiated gait was effective for alleviating the interruption of gait in 2 PD patients.

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Case Reports

Patient 1

A 70-year-old woman noticed short shuffling steps and difficulty in turning her body while walking at the age of 67. She gradually developed difficulty walking, mainly due to FOG. Neurological findings at the age of 67 revealed a depressive state, masked face, resting tremor, cogwheel type rigidity, bradykinesia, severe FOG, postural instability, and autonomic dysfunction, such as pollakisuria, constipation, and orthostatic hypotension. After gradual increases of L-dopa/decarboxylase inhibitor (DCI; 200–900 mg/day) and L-threo-3,4-dihydroxyphenylserine (100–600 mg/day), these parkinsonian symptoms improved, except for the severe FOG and postural instability (fig. 1a; see online suppl. video segment 1; for all online suppl. material, see www.karger.com/doi/10.1159/000362119). Visual and auditory cues also did not improve severe FOG and, therefore, her quality of life was limited. When she was instructed to imagine that she was pedaling a bicycle prior to trying to initiate gait, she was able to begin walking smoothly without FOG (fig. 1b; online suppl. video segment 2). Imagining taking a large step, climbing stairs, or stepping over regular horizontal lines did not improve severe FOG. When the patient was additionally instructed to imagine and mimic bicycling after having initiated walking, her gait was more rhythmical and without interruption (online suppl. video segment 2). There was little time between the first and second video segments. After several visits, severe FOG in its normal condition without imagining bicycling and the improvement of FOG after imagining bicycling were similar to the results shown in online supplementary video segments 1 and 2. Routine blood examinations were normal. The coefficient of variation of the R-R interval was reduced to 1.68%. A brain MRI showed mild chronic ischemic changes in the deep white matter. ^{99m}Tc -ECD SPECT showed mild hypoperfusion in the anterosuperior frontal and posterolateral parietal lobes. The heart-to-mediastinum (H/M) ratio in ^{123}I -metaiodobenzylguanidine myocardial scintigraphy decreased (early H/M: 1.89, delayed H/M: 1.68).

Patient 2

A 74-year-old woman found it difficult to begin walking at the age of 64. Neurological findings at the age of 66 revealed parkinsonism, such as microphonia, cogwheel type rigidity, bradykinesia, and FOG. She gradually developed difficulty walking due to severe FOG and postural instability (fig. 1c; online suppl. video segment 3). Although the administration of L-dopa/DCI (600 mg/day) and ropinirole (12 mg/day), and visual and auditory cues did not improve the severe FOG, she was able to walk without FOG after imagining bicycling (fig. 1d; online suppl. video segment 4), and the gait interruptions improved when imagining and mimicking bicycling after gait initiation (online suppl. video segment 4). Imagining taking a large step, climbing stairs, or stepping over regular horizontal lines did not improve severe FOG. Severe FOG in its normal condition without imagining bicycling and the improvement of the FOG after imagining bicycling were similar to the gaits shown in online supplementary video segments 3 and 4 after several visits. Routine blood examinations were normal. A brain MRI showed mild chronic ischemic changes in the deep white matter.

Discussion

FOG in these PD patients showed a remarkably good response to imagining bicycling, but not to anti-parkinsonian drugs, or visual or auditory cues. This possibly indicates that the pathophysiological mechanisms of FOG may include bilateral dyscoordination of steps

[6–8]. Although the mechanism by which imagining bicycling improved the FOG remains unclear, the rhythmical movement of the legs (i.e. alternating from side to side with one leg going up as the contralateral leg goes down) may be engendered by imagining bicycling. Attention does not seem to be highly related to the improvement of FOG because imagining taking a large step, climbing stairs, or stepping over regular horizontal lines did not improve it. Interestingly, their gait was rhythmical without interruption when imagining and mimicking bicycling after having initiated gait. Imagining and mimicking bicycling during gait may be able to influence gait control through higher cortical function.

Visual cues require conspicuous horizontal lines on the floor, while auditory cues require an audio instrument, such as a metronome. These external stimuli are hard to be used out of the house. On the other hand, an advantage of imagining bicycling is that it can be used anywhere. Although further investigation with a larger number of samples is needed, imagining bicycling, or imagining and mimicking bicycling could serve as a novel and simple therapeutic approach for intractable FOG or gait interruptions in PD patients.

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Disclosure Statement

The authors declare no conflicts of interest.

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Fig. 1. Photographs of patients. The photographs show FOG (**a, c**) and that it is released by imagining bicycling alone (**b, d**).